CLAIMS

1. An electromechanical system for digitally measuring and displaying location data for an instrument tip during a procedure on an animal being held by a stereotaxic holder, comprising:

(a) a manipulator system, having a base which can be securely affixed to the stereotaxic holder, and having an instrument attachment component to which at least one instrument having an instrument tip useful in procedures on animals can be securely affixed, wherein the instrument attachment component and an instrument affixed thereto can be moved in a controlled manner along each of three orthogonal axes, and having at least three electronic reader heads which are affixed to selected components of the manipulator system, wherein each reader head is positioned near an adjacent linear scaling device in a manner which will cause relative motion of the reader head with respect to its adjacent linear scaling device during motion of the instrument tip along a corresponding orthogonal axis, and wherein each reader head is designed to transmit, during use, electronic signals to a digital display device, said electronic signals being correlated to changeable locations of the instrument tip during a procedure; and,

(b) a digital display device, having (i) means for receiving electronic signals from at least three reader heads mounted on the manipulator system; (ii) data processing components and software, which together are capable of converting electronic signals originating from the reader heads into three independent and changeable orthogonal values expressed in digital form, said changeable orthogonal values being correlated to changeable locations of the instrument tip along orthogonal axes during an invasive procedure; (iii) means for displaying each of said orthogonal values, in either positive or negative form, in a manner clearly visible to a human operator,

wherein the digital display device is not rigidly affixed to the stereotaxic holder, and can be placed during use in a procedure in a location that is independent and separate from the stereotaxic holder.

2. The electromechanical system of Claim 1, wherein at least one reader head is provided with first means to emit electromagnetic radiation toward an adjacent reflective linear scaling device having at least one reflectivity trait that varies in a controlled manner along its length, and second means for measuring electromagnetic radiation which reflects off the adjacent reflective linear scaling device.

3. The electromechanical system of Claim 1, wherein at least one reader head uses a capacitance measuring system, to generate electronic signals which correlate to the reader head's position relative to an adjacent linear scaling device.

4. The electromechanical system of Claim 1, wherein each reader head, when acting in conjunction with an adjacent linear scaling device and with the digital display device, is capable of displaying linear positioning along an orthogonal axis with a resolution of about 20 microns or less.

5. The electromechanical system of Claim 1, wherein each reader head, when acting in conjunction with an adjacent linear scale and with the digital display device, is capable of displaying linear positioning along an orthogonal axis with a resolution of about 5 microns or less.

6. The electromechanical system of Claim 1, wherein the reader heads and linear scaling devices are made of mass-manufactured components that can be retrofitted onto an existing manipulator system of a conventional stereotaxic holder.

7. The electromechanical system of Claim 1, also comprising a flexible multi-lead cable which is capable of (i) supplying voltage to each of three reader heads in different locations; and (ii) carrying electronic signals from each of three reader heads to an electronic signal-processing device.

8. The electromechanical system of Claim 1, wherein the digital display device has at least three display panels, each of which can display positive and negative digital values independently of the other two panels.

9. The electromechanical system of Claim 1, wherein the digital display device comprises a programmable computer with a monitor.

10. The electromechanical system of Claim 1, wherein the digital display device is provided with means to: (a) allow a human operator to set a zero value for at least one displayed orthogonal value, by activating at least one triggering mechanism when the instrument tip is at a predetermined baseline location; and, (b) subsequently display at least one orthogonal location value by indicating a measured linear distance of the instrument tip from the predetermined baseline location, at each moment during the procedure.

11. The electromechanical system of Claim 1, wherein all components of the manipulator system are of a size, and are positioned in a manner, which allow a human operator to continuously observe an animal's head through a stereoscopic microscope, during a procedure on the animal.

12. The electromechanical system of Claim 1, wherein all components of the manipulator system are of a size, and are positioned in a manner, which allow a video camera positioned above the center of the base plate's anterior edge to obtain and provide, to a display monitor, continuous video images of

a procedure being carried out on an animal's head.

13. A stereotaxic manipulator system for providing digital displays of orthogonal locations of an instrument tip during a procedure on an animal being held by a stereotaxic holder, comprising:

(a) a manipulator base which can be affixed to a stereotaxic holder;

(b) an instrument attachment component which can be moved in a controlled manner along each of three orthogonal axes, by motion of interacting manipulator components;

(iii) at least three linear measuring systems, each comprising an electronic reader head mounted adjacent to a linear scaling device, in a manner which causes relative motion of the reader head with respect to the scaling device during operation of the manipulator system,

wherein the three linear measuring systems are oriented in a manner which effectively provides linear measurements along each of three orthogonal axes, and,

wherein each reader head is designed to generate electronic signals which (i) are correlated, at each moment during a procedure on an animal, with its position along its adjacent linear scaling device, to a resolution of about 20 microns or less, and (ii) can be converted to digital signals that can be processed and displayed by a digital display device.

14. The stereotaxic manipulator system of Claim 13, wherein at least one reader head is provided with first means to emit electromagnetic radiation toward a linear scaling device having at least one reflectivity trait that varies in a controlled manner along its length, and second means for measuring electromagnetic radiation which reflects off the linear scaling device.

15. The stereotaxic manipulator system of Claim 13,

wherein at least one reader head uses a capacitance measuring system, to generate electronic signals which correlate to the reader head's position relative to an adjacent linear scaling device.

16. The stereotaxic manipulator system of Claim 13, wherein each reader head, when acting in conjunction with an adjacent linear scale and with the digital display device, is capable of displaying linear positioning along an orthogonal axis with a resolution of about 5 microns or less.

17. The stereotaxic manipulator system of Claim 13, wherein the reader heads and linear scaling devices are made of mass-manufactured components that can be retrofitted onto an existing manipulator system of a conventional stereotaxic holder.

18. The stereotaxic manipulator system of Claim 13, also comprising a flexible multi-lead cable which is capable of (i) supplying voltage to each of three reader heads in different locations; and (ii) carrying electronic signals from each of three reader heads to an electronic signal-processing device.

19. The stereotaxic manipulator system of Claim 13, also comprising a digital display device that has at least three display panels, each of which can display positive and negative digital values independently of the other two panels.

20. The stereotaxic manipulator system of Claim 13, also comprising an analog-digital converter device which is capable of simultaneously converting at least three separate analog signals from the three reader heads into digital data which can be manipulated by a computer.

21. The stereotaxic manipulator system of Claim 13, wherein all components of the manipulator system are of a

size, and are positioned in a manner, which allow a human operator to continuously observe an animal's head through a stereoscopic microscope, during a procedure on the animal.

22. The stereotaxic manipulator system of Claim 13, wherein all components of the manipulator system are of a size, and are positioned in a manner, which allow a video camera positioned above the center of the base plate's anterior edge to obtain and provide, to a display monitor, continuous video images of a procedure being carried out on an animal's head.

23. A method for providing a stereotaxic manipulator with electronic components capable of digitally displaying location data for an instrument during a procedure on an animal, comprising the following steps:

a. securely affixing, to at least two components of a sliding base of the manipulator, a first scaling device and a first reader head, in a manner which causes relative motion of the first scaling device with respect to the first reader head during operation of the manipulator slide;

b. securely affixing, to at least two components of a vertical arm of the manipulator, a second scaling device and a second reader head, in a manner which causes relative motion of the second scaling device with respect to the second reader head during operation of the vertical arm; and,

c. securely affixing, to at least two components of a horizontal arm of the manipulator, a third scaling device and a third reader head, in a manner which causes relative motion of the third scaling device with respect to the third reader head during operation of the horizontal arm,

wherein each reader head is capable of emitting electronic signals that can be processed electronically to create digital displays of location data that vary during a procedure on an animal.

24. The method of Claim 23, wherein each reader head is provided with first means to emit electromagnetic radiation toward an adjacent reflective linear scaling device having at least one reflectivity trait that varies in a controlled manner along its length, and second means for measuring electromagnetic radiation which reflects off the adjacent reflective linear scaling device.

25. The method of Claim 23, wherein each reader head uses a capacitance measuring system to generate electronic signals which correlate to the reader head's position relative to an adjacent linear scaling device.

26. The method of Claim 23, wherein each reader head, when acting in conjunction with an adjacent linear scaling device, is capable of displaying linear positioning along an orthogonal axis with a resolution of about 5 microns or less.